

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Tae-wan KIM et al.

Serial No. 10/748,277

Filed: December 31, 2003

For: INDUCTIVELY COUPLED ANTENNA AND  
PLASMA PROCESSING APPARATUS  
USING THE SAME



Art Unit: 1763

Examiner: L.L. Alejandro Mulero

Confirmation No. 6602

Attorney Docket No. 249/409

TRANSMITTAL OF APPEAL BRIEF

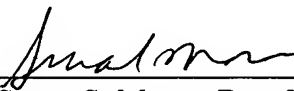
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA. 22313-1450

Sir:

This Appeal Brief is being filed together with the fee as set forth in 1.17 (c) in the amount of \$510.00 covering the appeal fee. The Commissioner of Patents is hereby authorized to charge the necessary fees to our credit card. Attached is PTO form 2038.

Respectfully submitted,  
LEE & MORSE, P.C.

Date: August 6, 2008

  
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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

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**BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192**

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401 Dulany Street  
Alexandria, Virginia 22314

Date: August 6, 2008

Sir,

**INTRODUCTORY COMMENTS**

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner of Art Unit 1763 who, in an Office action mailed January 7, 2008 (“outstanding Office action”), rejected claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 in the above-identified application. The period for reply is effectively extended by the attached Petition for Extension of Time. Appellants respectfully request consideration of this Appeal Brief by the Board of Patent Appeals and Interferences for reversal of the Examiner’s rejection of claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26.

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I. REAL PARTY IN INTEREST

The invention is assigned to Samsung Electronics Co., Ltd., 416 Maetan-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea.

II. RELATED APPEALS AND INTERFERENCES

To the best of appellants' knowledge, there are no prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 are pending in the subject application. A copy of claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 is set forth in the attached Claims Appendix.

Claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 are on appeal. Of these, claims 1 and 11 are independent claims.

IV. STATUS OF AMENDMENTS

On September 14, 2007, appellants filed an Amendment under 37 C.F.R. § 1.116 in response to the Office Action Made Final of July 25, 2007. After filing a Request for Continued Examination (RCE) on October 23, 2007, the Amendment was entered and a Non-Final Office action was mailed on January 7, 2008. Accordingly, all amendments made to the claims prior to the filing of this Appeal Brief have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

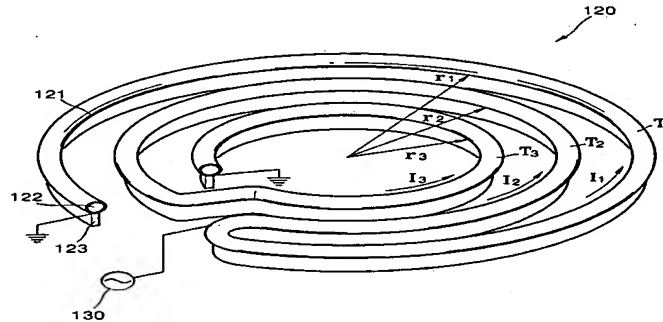
Embodiments of the claims on appeal generally relate to inductively coupled antennas. More particularly, embodiments of the claims on appeal generally relate to inductively coupled antennas employable by an inductively coupled plasma processing apparatus and inductively coupled plasma processing apparatus including an inductively coupled antenna.

Embodiments of the antennas as recited in each of independent claims 1 and 11 include a single coil having a plurality of turns including an outermost turn and a plurality of

inner turns. The outermost turn is connected in parallel with the plurality of inner turns and a sum of the lengths of the plurality of inner turns is longer than a length of the outermost turn.<sup>1</sup>

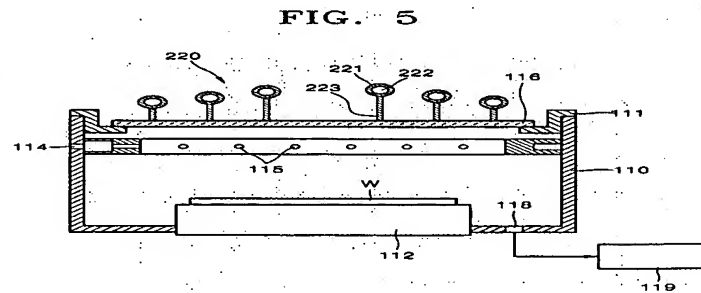
An exemplary embodiment of an inductively coupled antenna and an inductively coupled plasma processing apparatus, as respectively recited in independent claims 1 and 11, are illustrated in drawing FIGS. 4 and 5 of the application, which are reproduced below.

FIG. 4



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<sup>1</sup> See the instant application at, e.g., paragraphs [0034], [0035] and [0039].



More particularly, FIG. 4 of the instant application reproduced above illustrates an inductively coupled antenna 120 including an outermost turn  $T_1$ , and a plurality of inner turns, e.g., two inner turns  $T_2$ ,  $T_3$ . The outermost turn  $T_1$  is connected in parallel with the inner turns, e.g.,  $T_2$ ,  $T_3$ , and the inner turns, e.g.,  $T_2$ ,  $T_3$ , are connected together in series. The plurality of turns, e.g.,  $T_2$ ,  $T_3$ , are concentric relative to each other. The sum of the lengths of the inner turns, e.g.,  $T_2$ ,  $T_3$ , is longer than a length of the outermost turn  $T_1$ .<sup>2</sup>

As illustrated above, the outermost turn  $T_1$  and the inner turns, e.g.,  $T_2$ ,  $T_3$ , are portions of a single conductive line. Thus, separate connecting structures are not necessary to connect the turns of the antenna 120, and the antenna 120 may be easier to manufacture as compared to, e.g., antennas requiring separate connecting structures to connect turns thereof.<sup>3</sup>

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<sup>2</sup> See the instant application at, e.g., paragraphs [0032] through [0035].

<sup>3</sup> See the instant application at, e.g., paragraph [0039].

In some embodiments, the antenna 120 includes a conductive tube 121 and a conductive strip 123, e.g., tall and narrow rectangular strip that is electrically and thermally connected to a lower portion of the conductive tube 121. The tube 121 provides a cooling path 122 therein. Referring to FIG. 4, the conductive strip 123 may be coextensive with the tube 121. In some embodiments, the tube 121 has a circular cross-section, as illustrated, e.g., in FIG. 4.<sup>4</sup>

Referring to FIG. 5, an exemplary ICP processing apparatus includes a reaction chamber 110, an antenna 220, a gas injection port 114, a plurality of gas distribution ports 115, and a RF power supply (not shown). The antenna 220 is similar to the antenna 120 illustrated in FIG. 4, and includes a conductive metal tube 221 having a cooling path 222 and a conductive metal strip 223. Separately, embodiments employing an antenna, e.g., 120, 220, as recited in each of independent claims 1 and 11, enable current flowing through the outermost turn  $T_1$  to be controlled, e.g., increased, by controlling the length of radii  $r_1$ ,  $r_2$ , and  $r_3$  of the turns  $T_1$ ,  $T_2$ , and  $T_3$ . Thus, an induced electric field at an edge portion of the reaction chamber 110 is enhanced and plasma uniformity in the reaction chamber 110 is improved.<sup>5</sup>

Referring to FIGS. 4 and 5, in some embodiments, a height of the metal strip, e.g., 123, 223, may gradually decrease from a center portion to an edge portion of the antenna 120, 220.<sup>6</sup> An antenna including such a conductive strip, e.g., 123, 223, and a cooling path, e.g.,

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<sup>4</sup> See the instant application at, e.g., paragraphs [0040] through [0043].

<sup>5</sup> See the instant application at, e.g., paragraphs [0044] and [0045].

<sup>6</sup> See the instant application at, e.g., paragraph [0045].

122, 222, may be more efficiently cooled and thus, a shape of the antenna 123, 223 may be more easily maintained, e.g., without the use of an additional support and/or clamp.<sup>7</sup>

#### VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 stand rejected as follows:

- a) claims 1-2, 4-5, 11-12, 14-15 and 23-26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over WO 00/00993 to Chen et al. (“the Chen et al. reference”) in view of allegedly admitted prior art (“AAPA”) (FIG. 1 of the instant application and the corresponding written description thereof<sup>8</sup>); and
- b) claims 8-10 and 18-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the Chen et al. reference in view of AAPA as applied to claims 1-2, 4-5, 11-12, 14-15 and 23-26, and further in view of U.S. Patent No. 5,560,776 to Sugai et al. (“the Sugai et al. reference”) and U.S. Patent No. 5,531,834 to Ishizuka et al. (“the Ishizuka et al. reference”).<sup>9</sup>

Thus, each claim stands finally rejected on a single ground of rejection under 35 U.S.C. § 103(a). Appellants respectfully submit that each of these rejections is improper.

More particularly, on appeal, regarding the rejection of claims 1-2, 4-5, 11-12, 14-15 and 23-26 under 35 U.S.C. § 103(a), appellants stipulate that the rejection of dependent claims 2, 4-5, 11-12, 14-15 and 23-26, each of which directly or indirectly depend from one of independent claims 1 and 11, under 35 U.S.C. § 103(a) as being unpatentable over the

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<sup>7</sup> See the instant application at, e.g., paragraph [0043].

<sup>8</sup> See the Office action mailed January 7, 2008, full paragraph no. 1, page 3.

<sup>9</sup> See the Office action mailed January 7, 2008, paragraph no. 3, page 2; and paragraph no. 2, page 4.

Chen et al. reference in view of the AAPA stands or falls with the rejection of independent claims 1 and 11. Additionally, on appeal, regarding the rejection of dependent claims 8-10 and 18-22 under 35 U.S.C. § 103(a), each of which directly or indirectly depends from one of claims 21 and 22, appellants stipulate that the rejection of claims 8-10 and 18-20 under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA, and further in view of the Sugai et al. reference and the Ishizuka et al. reference stands or falls not only with the rejection of claims 21 and 22. Additionally, however, as the rejection of claims 8-10 and 18-22 is under 35 U.S.C. § 103(a) as being unpatentable over the Chen et al. reference in view of AAPA as applied to claims 1-2, 4-5, 11-12, 14-15 and 23-26, the rejection of claims 8-10 and 18-22 also stand or fall with the rejection of claims 1 and 11.

For the purposes of this appeal, appellants present the following ground of rejection for review:

- (1) whether independent claims 1 and 11 are unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA, and
- (2) whether claims 21 and 22, which directly depend from claims 1 and 11, respectively, are unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA as applied to claims 1-2, 4-5, 11-12, 14-15 and 23-26, and further in view of the Sugai et al. reference and the Ishizuka et al. reference.



## VII. ARGUMENT

### A. The Rejection of Independent Claims 1 and 11 as Being Unpatentable Under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA is Improper

Claims 1 and 11 stand rejected as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA. Appellants respectfully submit that this rejection is improper and should be reversed.

The law requires that the Examiner support a section 103(a) rejection by setting forth a *prima facie* case of obviousness.<sup>10</sup> A *prima facie* case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.<sup>11</sup> The Examiner must show that all of the claim limitations are taught or suggested by the prior art.<sup>12</sup> Further, the Examiner must show that there is some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or combine reference teachings to arrive at the claimed subject matter.<sup>13</sup> The requirement that there be a motivation to modify or combine reference teachings means that establishing a *prima facie* case of obviousness involves more than simply piecing together different elements of prior art references. The mere fact that references *can* be combined or modified is insufficient to establish motivation. Rather, the prior art must suggest the desirability of

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<sup>10</sup> *In re Deuel*, 51 F.3d 1552, 1557, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995).

<sup>11</sup> *In re Bell*, 991 F.2d 781, 783, 26 USPQ2d 1529; (Fed. Cir. 1993), quoting *In re Rinehart*, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976).

<sup>12</sup> *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

<sup>13</sup> *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

the modification or combination.<sup>14</sup> More particularly, the law requires an explicit and clearly articulated reason(s) as to why the claimed invention would have been obvious.<sup>15</sup>

Where, as here, the Examiner fails to establish a *prima facie* case of obviousness, appellants have no burden to rebut the obviousness rejection with evidence.<sup>16</sup> If the examination at the initial stage does not produce a *prima facie* case of unpatentability, then, without more, appellants are entitled to grant of the patent.<sup>17</sup>

As part of the *prima facie* case that the U.S. Patent Office is required to set forth when rejecting claims 1 and 11, the U.S. Patent Office must show that one of ordinary skill in the art would, by reading the Chen et al. reference and the AAPA, find it obvious to provide an inductively coupled antenna and an inductively coupled plasma processing apparatus including an antenna including an outermost turn and a plurality of inner turns having all the features respectively recited in each of claims 1 and 11. However, appellants respectfully submit that the U.S. Patent Office has failed to show that the combination of the Chen et al. reference and the AAPA discloses or suggests all of the elements recited claims 1 and 11, and has also failed to show that the prior art suggests the desirability of modifying or combining the cited reference and the AAPA.

Claims 1 and 11 of the instant application each recites, *inter alia*:

an antenna including a single coil having a plurality of turns including an outermost turn and a plurality of inner turns,

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<sup>14</sup> *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

<sup>15</sup> *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727.

<sup>16</sup> *In re Rijckaert*, 9 F.3d 1531, 1532, 28 USPQ2d 1955 (Fed. Cir. 1993).

<sup>17</sup> *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443 (Fed. Cir. 1992).

wherein the outermost turn is connected in parallel with the plurality of inner turns; and a sum of lengths of the plurality of inner turns is longer than a length of the outermost turn.

Appellants respectfully submit that the Chen et al. reference and the AAPA, taken as a whole, fail to disclose, or even suggest, all the elements of each of claims 1 and 11.

Therefore, no *prima facie* case of obviousness has been made out with respect to each of claims 1 and 11.

1. The Chen et al. reference and the AAPA fail to disclose or suggest an antenna including a single coil including an outermost turn and a plurality of inner turns, where the outermost turn of the coil is connected in parallel with the plurality of inner turns of the coil.

Appellants respectfully submit that both the Chen et al. reference and the AAPA fail to disclose or suggest an antenna including a single coil having a plurality of turns with all the features recited in each of claims 1 and 11. Further, appellants respectfully note that each of the terms, e.g., “turns,” “coil,” “outermost,” and “parallel”, of claims 1 and 11 should be considered. For example, appellants note that the relationship between “turns” and “coil” should be considered, i.e., a coil generally includes at least one turn, and that the terms “coil” and “turn” cannot be randomly interchanged.

Referring to the Chen et al. reference, in the Office action mailed January 7, 2008, the outstanding Office action acknowledges that the Chen et al. reference fails to disclose an antenna including a plurality of turns of a single coil,<sup>18</sup> and instead improperly relies on the AAPA for the “single coil” feature. Additionally, the outstanding Office action simply

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<sup>18</sup> See first sentence of full paragraph on page 3 of the Office action mailed January 7, 2008, where it is acknowledged that the Chen et al. reference fails to disclose a single conductive coil.

**broadly alleges** that antenna 600 in FIG. 6 of the Chen et al. reference discloses an “inductively coupled antenna comprising a coil having an outermost turn and a plurality of inner turns, ... and the outermost turn and the plurality of inner turns are connected to each other at the branch point.”<sup>19</sup>

As noted above, appellants respectfully submit that the outstanding Office action improperly interchanges the terms “coil” and “turn” and also *fails to identify, e.g., what alleged portion of the Chen et al. reference allegedly discloses a parallel connection between an outermost turn and a plurality of inner turns of a coil.* It is respectfully submitted that, *inter alia*, e.g., “an outermost turn” “a plurality of inner turns” and “connected in parallel” are each structural features of each of claims 1 and 11, which must be considered and disclosed and/or suggested by the applied art in order to establish a *prima facie* case of unpatentability for claims 1 and 11. It is respectfully submitted that the outstanding Office action fails to identify such features in the Chen et al. reference, alone or in combination with the AAPA, because the Chen et al. reference and the AAPA fail to disclose or suggest at least these features of independent claims 1 and 11.

More particularly, appellants respectfully submit that none of the embodiments of the Chen et al. reference disclose an antenna including a single coil including an outermost turn and a plurality of inner turns, where the outermost turn is connected in parallel with the plurality of inner turns. Even for the sake of argument only, if the “single coil” feature of claims 1 and 11 was ignored or it is assumed that the AAPA overcomes the “single coil”

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<sup>19</sup> See Office action mailed January 7, 2008, paragraph abridging pages 2 and 3.

deficiency of the Chen et al. reference, the Chen et al. reference still fails to disclose a coil including an *outermost turn* that is *connected in parallel* with a *plurality of inner turns*.

For example, FIG. 3 of the Chen et al. reference illustrates an antenna including a plurality of sub-coils each of which have a single turn. Thus, while the outer coil (coil 2) having a single turn may correspond to an outermost turn, the inner coil (coil 1) having only a single inner turn *does not include a plurality of inner turns* and accordingly does not satisfy all the features of the “plurality of inner turns” of each of claims 1 and 11. Further, with regard to FIGS. 4, 5 and 6 of the Chen et al. reference, while they may disclose an inner coil including a plurality of inner turns, the embodiments of FIGS. 4, 5 and 6 all illustrate an outer coil and an inner coil. While the Chen et al. reference discloses and illustrates a plurality of different embodiments, and even ignoring for the sake of argument only the “single coil” feature of claims 1 and 11, the Chen et al. reference still fails to disclose an outermost turn connected in parallel with a plurality of inner turns.

Still further, the **Chen et al. reference discloses that all embodiments (see FIGS. 3-7) have two or more spiral coils** (i.e., coil 1 and coil 2) positioned on a dielectric window of a plasma chamber (see page 4, lines 6-7 in the Chen et al. reference). Thus, the antenna of the Chen et al. reference cannot be a single coil system, and the Chen et al. reference teaches away from such a single coil system including an *outermost turn that is connected in parallel with the plurality of inner turns*, as recited in each of claims 1 and 11 of the instant application. Accordingly, contrary to the assertion on page 3 of the Office action mailed January 7, 2008, one of ordinary skill in the art at the time of the appellants’ invention would not have been motivated to combine the teachings of the AAPA with the Chen et al. reference to disclose an antenna including a single coil, as recited in each of claims 1 and 11. Appellants respectfully note that hindsight reconstruction should not be employed to assemble pieces of various prior art references in an attempt to recreate an antenna including

a single coil having a plurality of turns including an outermost turn and a plurality of inner turns, wherein the outermost is connected in parallel with the plurality of inner turns, as recited in each of claims 1 and 11.

More particularly, appellants respectfully submit that they identified, e.g., the problem of non-uniform density distribution of plasma in conventional ICP processing apparatus, particularly in view of the trend of larger and larger sized ICP processing apparatus. In particular, appellants identified the problem that as ICP processing apparatus are getting bigger in size, and a diameter of a reaction chamber are getting larger, non-uniformity of plasma density significantly increases. Appellants noted that with conventional antenna, the resulting induced electric field is relatively strong at a center portion of the antenna and weak at an edge portion of the antenna.<sup>20</sup> Further, by providing a “single coil” embodiments of the invention may help simplify manufacture thereof, relative to, e.g., antennas requiring separate connecting structures to connect turns thereof, by eliminating the need for separate connecting structures for connecting the turns of the antenna.<sup>21</sup>

Accordingly, appellants addressed shortcomings in the art and provide embodiments of an antenna, e.g., employable in an ICP processing apparatus, and capable of providing a more uniform density distribution and/or more simplified manufacturing process.<sup>22</sup> More particularly, an embodiment of the claims 1 and 11 enables current flowing through an outermost turn to be higher than current flowing through the plurality of inner turns such that

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<sup>20</sup> See the instant application at, e.g., paragraph [0007].

<sup>21</sup> See the instant application at, e.g., paragraph [0039].

<sup>22</sup> See the instant application at, e.g., paragraph [0011].

the resulting induced electric field at an edge portion of a reaction chamber may be enhanced so that plasma density may increase at an edge portion of the reaction chamber.<sup>23</sup>

For at least the reasons discussed above, appellants submit that the Chen et al. reference and the AAPA, alone or in combination, fail to disclose or suggest all the features of each of claims 1 and 11, and even assuming that the combination of the Chen et al. reference and the AAPA disclose or suggest all the features of each of claims 1 and 11, one of ordinary skill in the art would not have been motivated to combine the teachings thereof to disclose an antenna including a single coil as recited in each of claims 1 and 11. For at least these reasons, appellants respectfully submit that the rejection as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA is improper and should be reversed.

2. The Chen et al. reference and the AAPA fail to disclose or suggest an antenna including a single coil including an outermost turn and a plurality of inner turns, where a sum of lengths of the plurality of inner turns is longer than a length of the outermost turn.

As noted above, not only must the Examiner show that all of the claim limitations are taught or suggested by the prior art, the Examiner must also show that there is some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or combine reference teachings to arrive at the claimed subject matter. As discussed above, appellants respectfully submit that neither the Chen et al. reference nor the AAPA relied upon by the Examiner,

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<sup>23</sup> See the instant application at, e.g., paragraph [0037].

whether taken alone or in combination, disclose or suggest the claimed features and/or the desirability of modifying the prior art to arrive at the antenna *including an outermost turn and a plurality of inner turn, wherein the outermost turn is connected in parallel with the plurality of inner turns*, as recited in each of claims 1 and 11.

Moreover, as both the Chen et al. reference and the AAPA relied upon by the Examiner, whether taken alone or in combination, fail to disclose or *suggest an outermost turn and a plurality of inner turns* having all the features recited in each of claims 1 and 11, e.g., parallel connection, appellants also respectfully submit that the Chen et al. reference and the AAPA also fail to disclose or suggest “*a sum of lengths of inner turns being longer than a length of the outermost turn,*” as recited in each of claims 1 and 11. Accordingly, for at least the reasons discussed above, the Chen et al. reference and the AAPA also fail to disclose or suggest, *inter alia*, “a sum of lengths of inner turns being longer than a length of the outermost turn,” as recited in each of claims 1 and 11.



In view of the foregoing, appellants respectfully submit that the cited prior art references, whether taken alone or in combination, fail to disclose or suggest an antenna including a single coil having a plurality of turns including an outermost turn and a plurality of inner turns, wherein the outermost turn is connected in parallel with the plurality of inner turns and a sum of lengths of the plurality of inner turns is longer than a length of the outermost turn, as recited in each of claims 1 and 11. Accordingly, appellants respectfully submit that the U.S. Patent Office has failed to establish a *prima facie* case of obviousness with respect to claims 1 and 11. For at least these reasons, appellants respectfully submit that the rejection as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA is improper and should be reversed.

B. The Rejection of Claims 21 and 22 as Being Unpatentable Under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA in view of the Sugai et al. reference and the Ishizuka et al. reference is Improper

Claims 21 and 22 stand rejected as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA, and further in view of the Sugai et al. reference and the Ishizuka et al. reference. Appellants respectfully submit that this rejection is improper and should be reversed.

As set forth above, the law requires that the Examiner support a section 103(a) rejection by setting forth a *prima facie* case of obviousness.<sup>24</sup> A *prima facie* case of obviousness is established when the teachings from the prior art itself would appear to have

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<sup>24</sup> *In re Deuel*, 51 F.3d 1552, 1557, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995).

suggested the claimed subject matter to a person of ordinary skill in the art.<sup>25</sup> The Examiner must show that all of the claim limitations are taught or suggested by the prior art.<sup>26</sup> Further, the Examiner must show that there is some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or combine reference teachings to arrive at the claimed subject matter.<sup>27</sup> The requirement that there be a motivation to modify or combine reference teachings means that establishing a *prima facie* case of obviousness involves more than simply piecing together different elements of prior art references. The mere fact that references *can* be combined or modified is insufficient to establish motivation. Rather, the prior art must suggest the desirability of the modification or combination.<sup>28</sup>

Where, as here, the Examiner fails to establish a *prima facie* case of obviousness, appellants have no burden to rebut the obviousness rejection with evidence.<sup>29</sup> If the examination at the initial stage does not produce a *prima facie* case of unpatentability, then, without more, appellants are entitled to grant of the patent.<sup>30</sup>

As part of the *prima facie* case that the U.S. Patent Office is required to set forth when rejecting claims 21 and 22, the U.S. Patent Office must show that one of ordinary skill in the art would, by reading the Chen et al., the Sugai et al. and the Ishizuka et al. references and the

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<sup>25</sup> *In re Bell*, 991 F.2d 781, 783, 26 USPQ2d 1529; (Fed. Cir. 1993), quoting *In re Rinehart*, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976).

<sup>26</sup> *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

<sup>27</sup> *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

<sup>28</sup> *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

<sup>29</sup> *In re Rijckaert*, 9 F.3d 1531, 1532, 28 USPQ2d 1955 (Fed. Cir. 1993).

<sup>30</sup> *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443 (Fed. Cir. 1992).

AAPA, would find it obvious to provide an inductively coupled antenna and an inductively coupled plasma processing apparatus including an antenna including an outermost turn and a plurality of inner turns, a conductive metal tube having a cooling path, and a conductive metal strip having all the features respectively recited in each of claims 21 and 22.

Claims 21 and 21 of the instant application respectively depend from independent claims 1 and 11 discussed above, and *further to the features discussed above with regard to claims 1 and 11, recite, inter alia:*

a conductive metal tube having a cooling path; and  
a conductive metal strip that is electrically and thermally connected to the conductive metal tube and is coextensive with the conductive metal tube.

Appellants respectfully submit that the Chen et al. reference, the AAPA, the Sugai et al. reference and the Ishizuka et al. reference taken as a whole, fail to disclose, or even suggest, all the elements of each of claims 21 and 22 at least because the Sugai et al. reference and the Ishizuka et al. reference fail at the very least to overcome the deficiencies of the Chen et al. reference and the AAPA as discussed above with regard to claims 1 and 11, from which claims 21 and 22 respectively depend. For at least this reason, no *prima facie* case of obviousness has been made out with respect to each of claims 1 and 11.

Moreover, it is apparent that the U.S. Patent Office is using hindsight reconstruction to assemble pieces of various prior art references in an attempt to recreate the antenna of claim 21 and the ICP processing apparatus of claim 22 without regard to the operational configuration of the assembled pieces. This is clearly improper. More particularly, the

outstanding Office action broadly states that the strips (4, 5)<sup>31</sup> of the Sugai et al. reference corresponds to the metal strip recited in claims 21 and 22, and that the coil (13) of the Ishizuka et al. reference corresponds to the conductive metal tube having a cooling path recited in claims 21 and 22.<sup>32</sup>

However, the outstanding Office action fails to acknowledge that while the strips (4, 5) of the Sugai et al. reference may be positioned along a circumference of the coil (1), the strips (4, 5) *only contact the coil (1) at an end (Q) of the coil (1) by way of a plate (3)*.<sup>33</sup> That is, the Sugai et al. reference fails to disclose or suggest, *inter alia*, that the strips (4, 5) are coextensive with a conductive metal tube, as recited in claims 21 and 22. Accordingly, even assuming that one of ordinary skill in the art would have been motivated to combine the teachings of the Sugai et al., the Ishizuka et al. and the Chen et al. references with the AAPA, for at least the reasons discussed above, the combination of thereof fails to disclose or suggest each and every element of claims 21 and 22, e.g., a conductive metal strip that is electrically and thermally connected to the conductive metal tube and is coextensive with the conductive metal tube, as recited in claims 21 and 22. For at least these reasons, appellants respectfully submit that the rejection as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA, and further in view of the Sugai et al. reference and the Ishizuka et al. reference is improper and should be reversed.

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<sup>31</sup> See the Sugai et al. reference, at FIG. 1 and col. 4, lines 11-65.

<sup>32</sup> See Office action Mailed January 7, 2008, at page 4, fifth full paragraph.

<sup>33</sup> See the Sugai et al. reference, at FIGS. 1, 2, and 3(b), and col. 4, lines 18-22.

### CONCLUSION

Appellants respectfully submit that the cited references fail to disclose, even or suggest, each and every element of each of the rejected claims. In particular, appellants respectfully submit that the cited references, taken as a whole, fail to so much as suggest “a single coil” having a plurality of turns including “an outermost turn” and “a plurality of inner turns,” wherein the outermost turn is connected in parallel with the plurality of inner turns and a sum of lengths of the plurality of inner turns is longer than a length of the outermost turn, as recited in each of claims 1 and 11 of the instant application. Further, appellants respectfully submit that the Examiner has failed to show that the cited references disclose or suggest the desirability of modifying the teachings of the prior art to arrive at the single coil recited in each of claims 1 and 11.


In view of the foregoing, appellants respectfully submit that (1) the rejection of claims 1-2, 4-5, 11-12, 14-15 and 23-26 as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of the AAPA is improper and should be reversed, and (2) the rejection of claims 8-10 and 18-22 as being unpatentable under 35 U.S.C. § 103(a) over the Chen et al. reference in view of AAPA as applied to claims 1-2, 4-5, 11-12, 14-15 and 23-26, and further in view of the Sugai et al. reference the Ishizuka et al. reference is improper and should be reversed.

Appellants respectfully submit that these rejections are improper and should be reversed.

Respectfully submitted,

LEE & MORSE, P.C.

Date: August 6, 2008



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PETITION and  
DEPOSIT ACCOUNT CHARGE AUTHORIZATION

This document and any concurrently filed papers are believed to be timely. Should any extension of the term be required, appellants hereby petition the Director for such extension and requests that any applicable petition fee be charged to Deposit Account No. 50-1645.

If fee payment is enclosed, this amount is believed to be correct. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-1645.

Any additional fee(s) necessary to effect the proper and timely filing of the accompanying-papers may also be charged to Deposit Account No. 50-1645.

### VIII. CLAIMS APPENDIX

The pending claims as they stand on appeal are presented in a listing of the claims, below. Claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 are pending in the subject application.

Claims 1, 2, 4, 5, 8-12, 14, 15 and 18-26 are on appeal. Of these, claims 1 and 11 are independent claims.

#### Listing of the Claims:

1. (Previously Presented) An inductively coupled antenna, comprising:  
a single coil having a plurality of turns including an outermost turn and a plurality of inner turns, wherein the outermost turn is connected in parallel with the plurality of inner turns and a sum of lengths of the plurality of inner turns is longer than a length of the outermost turn.
2. (Previously Presented) The inductively coupled antenna as claimed in claim 1, wherein the outermost turn and the plurality of inner turns are connected to the RF power supply at a branch point of the outermost turn and the plurality of inner turns and the plurality of inner turns are connected to each other in series.
3. (Cancelled)
4. (Original) The inductively coupled antenna as claimed in claim 1, wherein the plurality of turns is concentrically formed.
5. (Previously Presented) The inductively coupled antenna as claimed in claim 1, wherein the plurality of turns are part of a single continuous conductive line.
6. (Cancelled)
7. (Cancelled)
8. (Previously Presented) The inductively coupled antenna as claimed in claim 21, wherein the conductive metal tube has a circular cross-section.

9. (Previously Presented) The inductively coupled antenna as claimed in claim 21, wherein the conductive metal strip has a long and narrow rectangular cross-section.

10. (Previously Presented) The inductively coupled antenna as claimed in claim 21, wherein the metal strip extends away from surface of an outer surface of the metal tube and a distance that the metal strip extends away from the outer surface of the metal tube gradually decreases from a center portion of the antenna to an end portion of the antenna.

11. (Previously Presented) An inductively coupled plasma (ICP) processing apparatus, comprising:

- a reaction chamber maintained in a vacuum state;
- an antenna installed on the reaction chamber to induce an electric field for ionizing a reactant gas injected into the reaction chamber and for generating plasma; and
- a RF power source that is connected to the antenna to supply RF power,

wherein the antenna is formed of a single coil having a plurality of turns, including an outermost turn and a plurality of inner turns, wherein the outermost turn is connected in parallel with the plurality of inner turns and wherein a sum of lengths of the plurality of inner turns is longer than a length of the outermost turn.

12. (Previously Presented) The ICP processing apparatus as claimed in claim 11, wherein the outermost turn and the plurality of inner turns are connected to the RF power supply at a branch point of the outermost turn and the plurality of inner turns and the plurality of inner turns are connected to each other in series.

13. (Cancelled)

14. (Previously Presented) The ICP processing apparatus as claimed in claim 11, wherein the plurality of turns are concentrically formed.

15. (Previously Presented) The ICP processing apparatus as claimed in claim 11, wherein the plurality of turns are part of a single continuous conductive line.



16. (Cancelled)

17. (Cancelled)

18. (Previously Presented) The ICP processing apparatus as claimed in claim 22, wherein the conductive metal tube has a circular cross-section.

19. (Previously Presented) The ICP processing apparatus as claimed in claim 22, wherein the conductive metal strip has a long and narrow rectangular cross-section.

20. (Previously Presented) The ICP processing apparatus as claimed in claim 22, wherein a distance that the metal strip extends away from an outer surface of the antenna gradually decreases from a center portion of the antenna to an end portion of the antenna.

21. (Previously Presented) The inductively coupled antenna, as claimed in claim 1, wherein the coil further comprises:  
a conductive metal tube having a cooling path; and  
a conductive metal strip that is electrically and thermally connected to the conductive metal tube and is coextensive with the conductive metal tube.

22. (Previously Presented) The ICP processing apparatus as claimed in claim 11, wherein the coil further comprises:  
a conductive metal tube having a cooling path; and  
a conductive metal strip that is electrically and thermally connected to the conductive metal tube and is coextensive with the conductive metal tube.

23. (Previously Presented) The inductively coupled antenna as claimed in claim 1, wherein the outermost coil is connected in parallel to each of the plurality of inner turns.

24. (Previously Presented) The inductively coupled antenna as claimed in claim 2, wherein the branch point of the outermost turn and the plurality of inner turns corresponds to a base point of a substantially U-shaped portion of the coil.

25. (Previously Presented) The ICP processing apparatus as claimed in claim 11, wherein the outermost coil is connected in parallel to each of the plurality of inner turns.

26. (Previously Presented) The ICP processing apparatus as claimed in claim 12, wherein the branch point of the outermost turn and the plurality of inner turns corresponds to a base point of a substantially U-shaped portion of the coil.

IX. EVIDENCE APPENDIX

Appellants make no reference to extrinsic evidence.

X. RELATED PROCEEDINGS APPENDIX

To the best of appellants' knowledge, there are no prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.